SIGNAL BOOK

UNITED STATES ARMY

1916

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1916

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Office of the Chief Signal Officer

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WAR DEPARTMENT,
OFFICE OF THE CHIEF OF STAFF,
Washington, April 15, 1916.

The following Signal Book, prepared by the Chief Signal Officer of the Army, is approved and herewith issued for the information and government of the Regular Army and the Organized Militia of the United States. It supersedes Signal Book, United States Army, 1914, and its provisions will be strictly observed throughout the service.

By order of the Secretary of War:

H. L. SCOTT,
Major General, Chief of Staff.

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SIGNAL BOOK

U. S. ARMY.

PART I.

GENERAL INSTRUCTIONS FOR ARMY SIGNALING.

1. Each signal station will have its call, consisting of one or two letters, as Washington, "W"; and each operator or signalist will also have his personal signal of one or two letters, as Jones, "Jo." These being once adopted will not be changed without due authority.

2. To lessen liability of error, numerals which occur in the body of a message should be spelled out.

3. In receiving a message the man at the telescope should call out each letter as received, and not wait for the completion of a word.

4. A record of the date and time of the receipt or transmission of every message must be kept.

5. The duplicate manuscript of messages received at, or the original sent from, a station should be carefully filed.

6. In receiving messages nothing should be taken for granted, and nothing considered as seen until it has been positively and clearly in view. Do not anticipate what will follow from signals already given. Watch the communicating station until the last signals are made, and be very certain that the signal for the end of the message has been given.

7. Every address must contain at least two words and should be sufficient to secure delivery.

8. All that the sender writes for transmission after the word "To" is counted.

9. Whenever more than one signature is attached to a message count all initials and names as a part of the message.

10. Dictionary words, initial letters, surnames of persons, names of cities, towns, villages, States, and Territories, or names of the Canadian Provinces will be counted each as one word; e. g., New York, District of Columbia, East St. Louis should each be counted as one word. The abbreviation of the names of cities, towns, villages, States, Territories, and provinces will be counted the same as if written in full.

11. Abbreviations of weights and measures in common use, figures, decimal points, bars of division, and in ordinal numbers the affixes "st," "d," "nd," "rd," and "th" will be each counted as one word. Letters and groups of letters, when such groups do not form dictionary words and are not combinations of dictionary words, will be counted at the rate of five letters or fraction of five letters to a word. When such groups are made up of combinations of dictionary words, each dictionary word so used will be counted.

12. The following are exceptions to paragraph 55, and are counted as shown:

A. M.	1 word
P. M.	1 word
O. K.	1 word
Per cent	1 word

13. No message will be considered sent until its receipt has been acknowledged by the receiving station.

PART II.

THE AMERICAN MORSE CODE.

14. The American Morse Code will be used officially by the Army in the operation of land telegraph lines, short cables, and field telegraph lines. It is written as follows:

Alphabet.

A	•—	O	— — —
B	—•••	P	•••••
C	—•—•	Q	••—•
D	—••	R	•—•
E	•	S	•••
F	••—•	T	—
G	——•	U	••—
H	••••	V	•••—
I	••	W	•——
J	•———	X	—••—
K	—•—	Y	—•——
L	•—••	Z	——••
M	——	&	•—•••
N	—•		

Numerals.

1	•————	6	—••••
2	••———	7	——•••
3	•••——	8	———••
4	••••—	9	————•
5	•••••	0	—————

Punctuation.

Period		•—•—•—
Comma		——••——
Interrogation		••——••
Hyphen	(HX)	—••••—
Dash	(DX)	—•••——
Parenthesis (begin)	(PN)	—•——•
Parenthesis (end)	(PY)	—•——•—
Quotation marks (begin)	(QN)	•—••—•
Quotation marks (end)	(QJ)	•—••—•—
Dollar mark	(SX)	•••—••—
Decimal point		Spell "dot."
Capitalized letter	(CX)	•• • •—••
Brackets	(BX)	—•••—•—••
Colon	(KO)	———•••

Semicolon	(SI)	••• ••
Underline (begin)	(UX)	••— •—••
Underline (ens)	(UJ)	••— —•—•
Colon dash	(KX)	—•—• •—••
Colon followed by quotation	(KQ)	—•—• ••—••
Exclamation point	(!)	——••
Fraction bar	(/)	••
Paragraph mark	(¶)	•—••—•
Pounds, sterling	(£) (PX)	••••• •—••
Shilling mark	(UT)	••— —

Abbreviations.

af	after	nite	night
ahr	another	nl	night letter
b	be	npr	night press rate
bf	before	ob	official business
bn	been	pd	paid
ck	check	r	are
cn	can	t	the
da	day	u	you
dl	day letter	ur	your
dpr	day press rate	w	with
fm	from	wrd	word
gn	good-night	x (in check)	get a reply to this message
govt	government		
hr	hear or here	5	Have you anything for me?
hv	have		
msg	message	13	understand

CONVENTIONAL SIGNALS FOR USE WITH THE AMERICAN MORSE CODE.

15. The following conventional signals will be used on military telegraph lines, short cables, and field lines:

Attention, all operators [1]	(9)	—••—•
Please start me (or) where shall I start	(4)	••••—
Wait a moment	(MIN)	•—— •• —••
Official message	(OFM)	• • •—•• ——
I understand	(OK)	• • —•—•
Busy on other wires	(25)	••—•• ——
No more	(NM)	—• ——
Test, give away	(WIRE)	•—— •• • •• ••
Break	(BK)	—••• —•—•
Go ahead	(GA)	——•—• •—•
Error	(DN)	—•• —••
Signature follows	(SIG)	••• •• ——•—•

[1] See Emergency signals, Part XIII.

TRANSMISSION OF FIELD MESSAGES BY AMERICAN MORSE.

16. The sending operator will enter the time *when the message is handed him for transmission*, in the left-hand corner at the bottom of the blank opposite the word "Received." He will enter in the proper places, at the head of the blank, the number of the message, the call letter of his station, with his personal signal, the check (number of words or groups of cipher contained in message, *counting address and signature*), and after "O. K." has been received he will enter the time the message was sent and the call letter of the receiving station, with the personal signal of the receiving operator.

17. To transmit a message the operator will send (1) the number of the message and call letter of his station; (2) his personal signal; (3) the check; (4) "fm," followed by the name of the sending detachment; (5) "at," followed by the location of the sending detachment and date; (6) "ho," followed by the hour (a. m. or p. m.) message was written; "No." (Sender's serial number); (7) "to," followed by the address in full; (8) period (. . — — . .); (9) body or text of the message; (10) "sig," followed by the signature of the message.

PART III.

THE INTERNATIONAL MORSE OR GENERAL SERVICE CODE.

18. The International Morse Code is the General Service Code and is prescribed for use by the Army of the United States and between the Army and the Navy of the United States. It will be used on radio systems, submarine cables using siphon recorders, and with the heliograph, flash-lantern, and all visual signaling apparatus using the wig-wag.

Alphabet.

A	• —	N	— •
B	— • • •	O	— — —
C	— • — •	P	• — — •
D	— • •	Q	— — • —
E	•	R	• — •
F	• • — •	S	• • •
G	— — •	T	—
H	• • • •	U	• • —
I	• •	V	• • • —
J	• — — —	W	• — —
K	— • —	X	— • • —
L	• — • •	Y	— • — —
M	— —	Z	— — • •

Numerals.

1	• — — — —	—	— • • • •
2	• • — — —	7	— — • • •
3	• • • — —	8	— — — — • •
4	• • • • —	9	— — — — — •
5	• • • • •	0	— — — — —

Punctuation.

Period	• • • • • •
Comma	• — • — • —
Interrogation	• • — — • •
Hyphen or dash	— • • • • —
Parentheses (before and after the words)	— • — — • —
Quotation mark (beginning and ending)	• — • • — •
Exclamation	— — • • — —
Apostrophe	• — — — — •

Semicolon..... — • — • — •
Colon..... — — — • • •
Bar indicating fraction..... — • • — •
Underline (before and after the word or words it is wished to underline)..... • • — — • —
Double dash (between preamble and address, between address and body of message, between body of message and signature, and immediately before a fraction)..... — • • • —
Cross..... • — • — •

Conventional Signals for Use by Radio Stations with the International Morse Code.

19. The following conventional signals will be used by radio stations of the United States Army with the International Morse Code:

Distress signal (ship stations only)[1]	• • • — — — • • •
Attention (or call)	The call is composed of the attention signal — • — • — followed by the call letters of the station called, repeated three times (if unknown use CQ (— • — • — — • —) in place of call letters of station called), followed by DE (— • • •) and then the call letters of the calling station, repeated three times.
Have you anything for me	QRU (— — • — • — • • —)
How many words have you to send	QRJ (— — • — • — • • — — —)
Invitation to transmit (go ahead)	— • —
Signal separating preamble from address, address from text, and text from signature	— • • • —
End of message	• — • — •
End of work	• • • — • —, followed by the call letter of sending station and — • —
Received (acknowledgment of receipt of message)	R (• — •), followed by the call letter of the receiving station and personal signal of the receiving operator.
Here is another message	— • — • — (attention call).
Understood (or I understand)	• • • — •, followed by the call letters of station.
Not understood (or repeat)	• • — — • • (Interrogatory) and the last word received.
Error	• • • • • • • •

[1] See Emergency signals, Part XIII.

Wait.....• — • • •
Official message.....OFM (— — — • • — • — —)
(First word of preamble on all radiograms) RADIO (• — • — • • — • • — — — —)
Faster.....QRQ (— — • — • — • — — • —)
Slower.....QRS (— — • — • — • • •)
Stop sending.....QRT (— — • — • — • —)
Interference.....XX (— • • — — • • —)
Use International Code of Signals.....PRB (• — — • • — • — • • —)
General inquiry call (when call of station is not known).....CQ (— • — • — — • — —) (see attention call).
How do you receive me.....QRK (— — • — • — • — • —

Transmission of Messages by International Morse.

EXAMPLE.

20. WVB sending to WVA a plain commercial message filed at 4 p. m., of the 12th, after receiving — • —

— • — • —
RADIO
Circle City.....Office of destination.
De.
Fairbanks.....Office of origin.
2.....Number of message.
L.....Operator's sign.
8.....Check.
Twelfth 4 pm.....Date and hour of filing.
— • • • — .....Break or double dash.
Brown 175 King Street
Circle City.....Address.
— • • • — .....Break.
Arrive tomorrow.....Text.
— • • • — .....Break.
Jones.....Signature.
• — • — •
KMO
— • —

PART IV.

VISUAL SIGNALING IN GENERAL.

21. Methods of visual signaling are divided as follows:

(*a*) By flag, torch, hand lantern, or beam of searchlight (without shutter). (General Service Code.)

(*b*) By heliograph, flash lantern, or searchlight (with shutter). (General Service Code.)

(*c*) By Ardois. (General Service Code.)

(*d*) By hand flags or by stationary semaphore. (Two-arm semaphore Code.)

(*e*) By preconcerted signals with Coston lights, rockets, bombs, Very pistols, small arms, guns, etc.

(*f*) By flag signals by permanent hoists. (International Code.)

22. The following conventional signals, with exceptions noted, will be used in the first four classes.

		Exceptions. Ardois and semaphore.
End of word.	Interval.	
End of sentence.	Double interval.	
End of message.	Triple interval.	
Signal separating preamble from address; address from text; text from signature.	— • • • —	Double interval, signature preceded also by "Sig." Interval.
Acknowledgement.	R.	
Error.	• • • • • • • •	A.
Negative.	K.	
Preparatory.	L.	
Annuling.	N.	
Affirmative.	P.	
Interrogatory.	• • — — • •	O
Repeat after word.	Interrogatory, A (word).	
Repeat last message.	Interrogatory three times.	
Send faster.	QRQ	
Send slower.	QRS	
Cease sending.	QRT	
Wait a moment.	• — • • •	None.
Execute.	IX, IX	
Move to your right.	MR	
Move to your left.	ML	
Move up.	MU	
Move down.	MD	
Finished (end of work).	• • • — • —	None.

NOTE.—In order to differentiate these signals from important battle signals, the Navy uses certain distinguishing variations which are not necessary in signaling in the Army. In making the conventional signals for "A," Error, and "O," Interrogatory, in Ardois, the Navy indicates them by pulsating the upper light, in making them in semaphore, by agitating the arms or flags. "K," Negative; "L," Preparatory; "N," Annuling; "O," Interrogatory; and "P," Affirmative, in the Navy are secondary meanings, and are used only in connection with Navy Code Books. They should not be used in communication between the Army and Navy.

In communicating with the Navy, by all methods, numerals will be spelled out.

"Intervals" are expressed as follows in the various systems:

	Interval.	Double interval.	Triple interval.
Radio. Flashing. Occulting light. Sound.	— space.	.. .. ..	.—.—.
Wigwag.	Front.	(Twice.)	(3 times.)
Semaphore.	Flags crossed or machine closed.	2 chops.	3 chops, withdraw flags or close machine and indicator arm.
Ardois.	.—.—	(Twice.)	(3 times.)

PART V.

VISUAL SIGNALING: BY FLAG, TORCH, HAND LANTERN, OR BEAM OF SEARCHLIGHT (WITHOUT SHUTTER).

GENERAL SERVICE CODE.

23. For the flag used with the General Service Code there are three motions and one position. The position is with the flag held vertically, the signalman facing directly toward the station with which it is desired to communicate. The first motion (the dot) is to the right of the sender, and will embrace an arc of 90°, starting with the vertical and returning to it, and will be made in a plane at right angles to the line connecting the two stations. The second motion (the dash) is a similar motion to the left of the sender. The third motion (front) is downward directly in front of the sender and instantly returned upward to the first position. Front is used to indicate an interval.

24. The beam of the searchlight, though ordinarily used with the shutter like the heliograph, may be used for long-distance signaling, when no shutter is suitable or available, in a similar manner to the flag or torch, the first position being a vertical one. A movement of the beam 90° to the right of the sender indicates a dot, a similar movement to the left indicates a dash; the beam is lowered vertically for front.

25. To use the torch or hand lantern, a footlight must be employed as a point of reference to the motion. The lantern is most conveniently swung out upward to the right of the footlight for a dot, to the left for a dash, and raised vertically for front.

Part VI.

SIGNALING WITH HELIOGRAPH, FLASH LANTERN, OR SEARCHLIGHT (WITH SHUTTER).

General Service Code.

26. The first position is to turn a steady flash on the receiving station. The signals are made by short and long flashes. Use a short flash for dot and a long steady flash for dash. The elements of a letter should be slightly longer than in sound signals.

27. To call a station make its call letter until acknowledged.

28. If the call letter of a station be unknown, signal A until acknowledged. Each station will then turn on a steady flash and adjust. When the adjustment is satisfactory to the called station, it will cut off its flash, and the calling station will proceed with its message.

29. If the receiver sees that the sender's mirror or light needs adjustment, he will turn on a steady flash until answered by a steady flash. When the adjustment is satisfactory, the receiver will cut off his flash and the sender will resume his message.

30. To break the sending station for other purposes, turn on a steady flash.

31. It may be noted that in the daytime and in ordinary weather the searchlight with shutter can be readily used for distances up to 10 miles at sea. This method of day signaling is considered of exceptional value by the Navy, and is commonly used by the Coast Artillery in target practice from the shore to the tug towing the target. It is independent of background and may be used behind armor or other shelter; it should be frequently used for signaling by day as well as by night.

Part VII.

THE ARDOIS SYSTEM.

General Service Code.

32. The Ardois system, used in the United States Army and Navy, is a display of four lights, each of which may be made either red or white. These lights are incandescent lamps, operated by a keyboard conveniently placed at the station. The red light indicates a dot and the white light a dash, so that the characters of the General Service Code are made by combinations of red and white lights.

33. If the lights are arranged vertically, as when swung from a staff or spar, they are read from the top downward. If the lights are placed horizontally, they are read from the sender's right to his left.

34. Example: Red-white, or dot-dash, represents the letter A; and white-red-red-red, or dash-dot-dot-dot, represents the letter B.

35. For numerals in the Ardois system, secondary meanings (as numerals) have been assigned to the last 10 letters, Q being 1, R being 2, and so on, Z being 0. These secondary meanings are not used in communicating with the Navy; when communicating with the Navy the numerals of the International Morse Code must be spelled out in full.

36. When the letters of the alphabet are to be used to indicate the meaning set opposite them in the following tabulation, the upper light of the display is pulsated. This is effected by means of a special pulsating key.

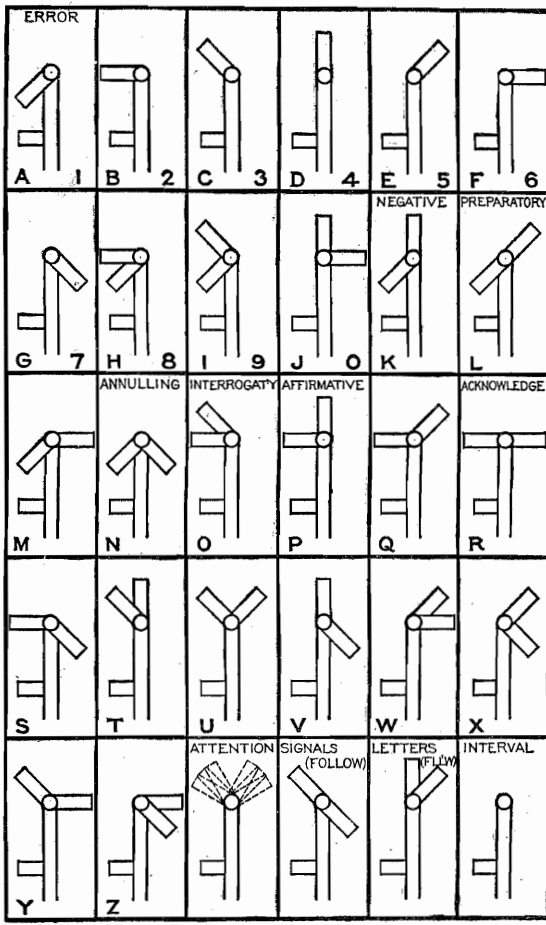
RULES FOR USING THE ARDOIS SYSTEM OF SIGNALING.

37. In signaling by the Ardois system the Cornet, WWWW, is a general call to attention. A station desiring to exchange signals will display the call letters of the station wanted, which will be answered by a similar display from the station called, or from each station successively called.

38. If the call letters of a station be unknown, display the Cornet.

39. The calls having been answered, proceed with the message, or if a special or preconcerted code is to be used, so indicate, and when answered proceed with the message.

40. If it becomes necessary to put a signal message into cipher, the marking of the Ardois keyboard is on no account to be changed to accomplish this object.



NOTE.—The positions "Signals Follow" and "Letters Follow" are used in the Navy in connection with Navy Code Books. They are included for the information of, but not for use in, the Army.

PART VIII.

SIGNALING BY TWO-ARM SEMAPHORE.

STATIONARY SEMAPHORE.

41. The machine or stationary semaphore is authorized for general use by the Army at the present time. A third arm or "indicator" is displayed on the right of the sender, the left as viewed by the receiver. At night a red light screened to the rear indicates the direction of sending.

42. The machine will be mounted at some point so situated that it may be seen through the greatest arc of the horizon. By means of electric lights installed on the vanes, the machine is made available for night as well as for day signaling. The vanes of the semaphore machine shall be painted yellow.

43. Signaling by the two-arm semaphore is the most rapid method of sending spelled-out messages. It is, however, very liable to error if the motions are slurred over or run together in an attempt to make speed. Both arms should move rapidly and simultaneously, but there should be a perceptible pause at the end of each letter before making the movements for the next letter. Rapidity is secondary to accuracy. For alphabet see plate opposite.

The "interval" is the machine closed, but with the indicator showing; "double interval" is the "chop-chop" signal made twice, both arms being placed at the right horizontal and then moved up and down in a cutting motion, the indicator being displayed. The "triple interval" is indicated by the "chop-chop" signal made three times.

HAND FLAGS.

44. Hand flags are authorized for general use by the Army, though on account of their small range they are of limited application, and are chiefly serviceable for use within organizations,

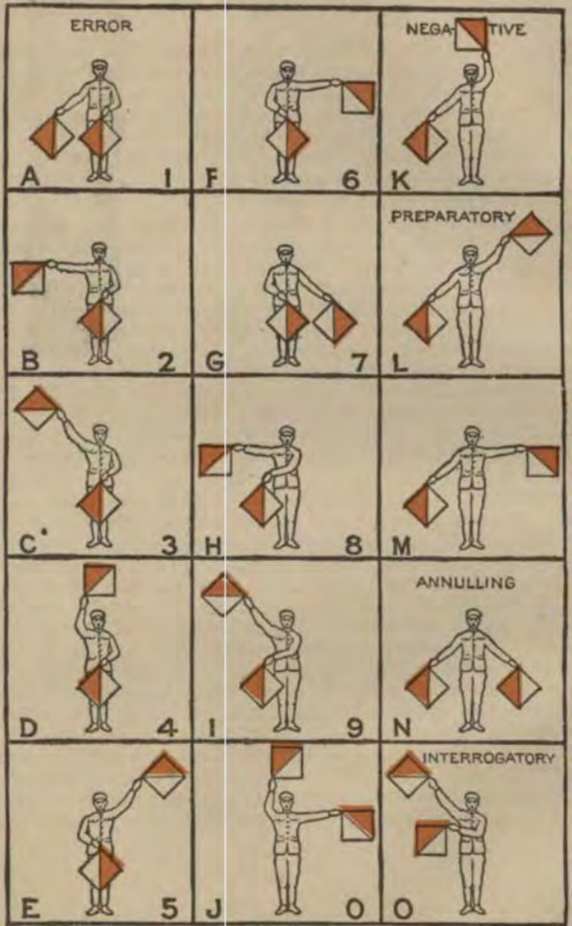
within fixed positions, or for incidental signaling. The range with flags of the usual size is of course dependent upon light and background, but is seldom more than one mile with the naked eye. This system of signaling has been highly developed in the Navy, and on account of its rapidity and simplicity is of use to the Army and should be familiar to all soldiers. It is limited to visual signaling work and not adapted to general signaling as is the General Service Code. It will be found useful under many circumstances and is adapted to special work when rapid communication for short distances is needed. This method is also used to advantage for interior signaling within batteries of the field artillery and regiments of infantry, and will, at times, be convenient for the cavalry.

45. The semaphore hand flags for service use, except those now temporarily issued to the field and the coast artillery, are 18 inches square divided diagonally into two parts, one of red and the other white; the staffs are 24 inches long. (See plate.)

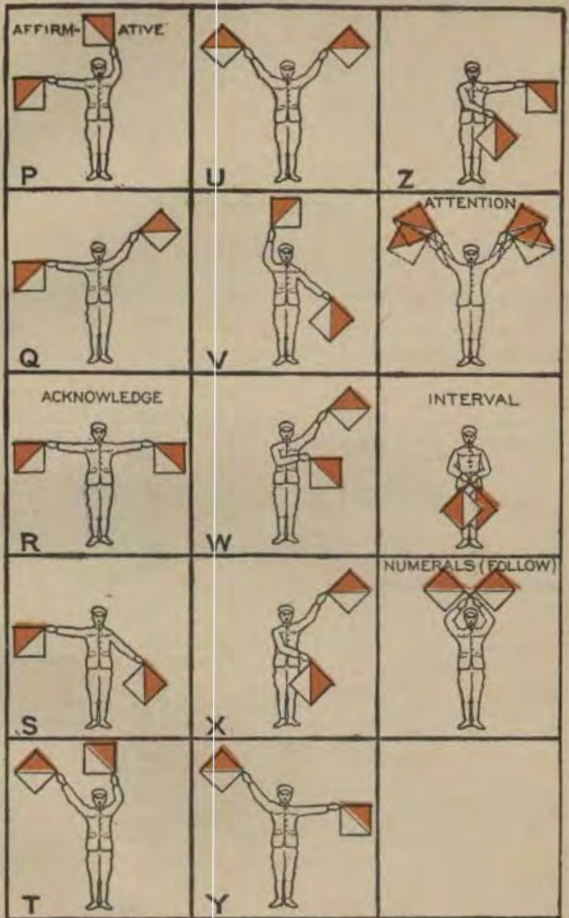
For the field and the coast artillery there is now issued a semaphore hand flag of orange with a scarlet center and scarlet with an orange center, one of each constituting a kit. The flags are 18 inches square, the centers 9 inches square, and the staffs 24 inches long.

The hand flags of the Navy are from 12 to 15 inches square, of blue with a white square, or red and yellow diagonally, the colors to be used depending upon the background. The flags are usually attached to a light wooden staff about 2 feet in length.

46. Hand flags are used in the same manner as the semaphore machine, except that in making the interval the flags are crossed downward in front of the body (just above the knees); the double interval is the "chop-chop" signal made twice. The triple interval is "chop-chop" signal made three times. In calling a station face it squarely and make its call. If there is no immediate reply wave the flags over the head to attract attention, making the call at frequent intervals. When the sender makes "end of message" the receiver, if message is understood, extends the flags horizontally and waves them until the sender does the same, when both leave their stations. Care must be taken with hand flags to hold the staffs so as to form a prolongation of the arms.


ERROR
A
I
F
6
NEGA-
TIVE
K
B
2
G
7
PREPARATORY
L
C
3
H
8
M
D
4
I
9
ANNULLING
N
E
5
J
0
INTERROGATORY
O

THE TWO-ARM SEMAPHORE CODE WITH HAND FLAGS.



PART IX.

LETTER CODES.

INFANTRY.

47. For use with General Service Code or semaphore hand flags.

Letter of alphabet.	If signaled from the rear to the firing line.	If signaled from the firing line to the rear.
AM	Ammunition going forward.	Ammunition required.
CCC	Charge (mandatory at all times).	Am about to charge if no instructions to the contrary.
CF	Cease firing.	Cease firing.
DT	Double time or "rush."	Double time or "rush."
F	Commence firing.	
FB	Fix bayonets.	
FL	Artillery fire is causing us losses.	
G	Move forward.	Preparing to move forward.
HHH	Halt.	
K	Negative.	Negative.
LT	Left.	Left.
O (Ardois and semaphore only.)	What is the (R. N., etc.)? Interrogatory.	What is the (R. N., etc.)? Interrogatory.
• • — — • • (All methods but ardois and semaphore.)	What is the (R. N., etc.)? Interrogatory.	What is the (R. N., etc.)? Interrogatory.
P	Affirmative.	Affirmative.
RN	Range.	Range.
RT	Right.	Right.
SSS	Support going forward.	Support needed.
SUF	Suspend firing.	Suspend firing.
T	Target.	Target.

CAVALRY.

48. For use with General Service Code or semaphore hand flags.

AM—Ammunition going forward (if signaled from the rear to the front).
Ammunition required (if signaled from the front).
CCC—Charge (if signaled from the rear to the front).
About to charge if no instructions to the contrary (if signaled from the front).
CF—Cease firing.
DT—Double time, rush, or hurry.
F—Commence firing.
FL—Artillery fire is causing us losses.
G—Move forward (if signaled from the rear to the front).
Preparing to move forward (if signaled from the front).
HHH—Halt.
K—Negative.
LT—Left.
M—Bring up the horses (if signaled from front to rear).
Horses going forward (if signaled from rear to front).
O—What is the (R. N., etc.)? Interrogatory. (Ardois and semaphore only.)
. . — — . .—What is the (R. N., etc.)? Interrogatory. (All methods but ardois and semaphore.)
P—Affirmative.
R—Acknowledgment.
RN—Range.
RT—Right.
SSS—Support going forward (if signaled from the rear to the front).
Support needed (if signaled from the front).
SUF—Suspend firing.
T—Target.

FIELD ARTILLERY.

49. For use with General Service Code or semaphore hand flags.

. . . . . .—Error. (All methods but ardois and semaphore.)
A—Error. (Ardois and semaphore only.)
AD—Additional.
AKT—Draw ammunition from combat train.
AL—Draw ammunition from limbers.
AM—Ammunition going forward.
AMC—At my command.
AP—Aiming point.
B (numerals)—Battery (so many) rounds.

BS (numerals)—(Such.) Battalion station.
BL—Battery from the left.
BR—Battery from the right.
CCC—Charge (mandatory at all times). Am about to charge if not instructed to contrary.
CF—Cease firing.
CS—Close station.
CT—Change target.
D—Down.
DF—Deflection.
DT—Double time. Rush. Hurry.
F—Commence firing.
FCL (numerals)—On 1st piece close by (so much).
FL—Artillery fire is causing us losses.
FOP (numerals)—On 1st piece open by (so much).
G—Move forward. Preparing to move forward.
HHH—Halt. Action suspended.
IX—Execute. Go ahead. Transmit.
JI—Report firing data.
K—Negative. No.
KR—Corrector.
L—Preparatory. Attention.
LCL (numerals)—On 4th piece close by (so much).
LOP (numerals)—On 4th piece open by (so much).
LT—Left.
LL—Left from the left.
LR—Left from the right.
LE (numerals)—Less (so much).
MD—Move down.
ML—Move to your left.
MR—Move to your right.
MU—Move up.
MO (numerals)—Move (so much).
N—Annul, cancel.
O—What is the (R. N., etc.)? Interrogatory. (Ardois and semaphore only.)
• • — —• •—What is the (R. N., etc.)? Interrogatory. (All methods but ardois and semaphore.)
P—Affirmative. Yes.
PS—Percussion. Shrapnel.
QRQ—Send faster.
QRS—Send slower.
QRT—Cease sending.
R—Acknowledgment. Received
RS—Regimental station.
RL—Right from the left.
RR—Right from the right.
RN—Range.
RT—Right.
S—Subtract.
SCL (numerals)—On 2d piece close by (so much).

SOP (numerals)—On 2d piece open by (so much).
SH—Shell.
SI—Site.
SSS—Support needed.
T—Target.
TCL (numerals)—On 3d piece close by (so much).
TOP (numerals)—On 3d piece open by (so much).
U—Up.
Y (letter)—Such battery station.

COAST ARTILLERY.

50. FOR SHORE-TUG SIGNALING.

1. Range correct, ready to fire	K
2. Commence towing	C
3. Go out	O
4. Come in	I
5. Distress	D
6. Hold stationary	S
7. Turn	T
8. Incline to port	L
9. Incline to starboard	R
10. Close practice	Z

NOTE.—EXPLANATION OF SHORE-TUG SIGNALS.

Range correct, ready to fire.—This signal is supplementary to the firing signal displayed at the battery firing. At mortar subcaliber practice this signal may be sent as each shot is fired.

Commence towing.—This signal means that the towing vessel will at once take up the bearing course prescribed. It is understood that in every case the course on which the target is to be towed is to be indicated by compass bearings furnished to the officer in charge of the towing vessel. By this means it will only be necessary to get the target on any one point of the course and then send the signal "commence towing."

This signal may be given at any time, with the towing vessel stationary or moving in any direction, and means that the vessel will at once take up the prescribed bearing course.

Go out.—This signal directs the vessel to move straightaway from the battery firing.

Come in.—This signal directs the vessel to move straight toward the battery firing.

Distress.—This signal sent by the tug indicates either that the tug is unable to proceed, due to fouling, breakdown, shoals, or other cause; or that, at night practice, a shore searchlight is interfering with a patrol boat. After the trouble passes, signal No. 1 should be given by the tug. If the searchlight can not be used, distress signals should be made by whistle. In any case, the nature of the trouble should be immediately communicated by shutter or radio, using the General Service Code.

Hold stationary.—This signal indicates that the vessel is to lie to until further orders are given. It is equivalent to the term "stand fast" of Drill Regulations.

Turn.—This signal indicates that the vessel is to go about, or make a turn of 180°. If given after No. 6 (hold stationary), it means that the vessel will run a course of 180° from that on which she was proceeding when No. 6 was given.

Incline to port.—Given when the vessel is on a course, it indicates that the vessel will incline to port two points. Given after No. 6 (hold stationary), it directs the vessel to run on a course two points to port of that on which she was proceeding when No. 6 was given.

Incline to starboard.—Given when a vessel is on a course, it indicates that the vessel will incline to starboard two points. Given after No. 6 (hold stationary), it directs the vessel to run on a course two points to starboard of that on which she was proceeding when No. 6 was given.

Close practice.—This signal means that firing is over for the day and that the towing vessel will proceed to carry out such special directions as may have been given relative to securing and bringing in targets.

PART X.

CONVENTIONAL AND PRECONCERTED SIGNALS WITH ROCKETS, BOMBS, SMALL ARMS, GUNS, COSTON LIGHTS, VERY PISTOLS, ETC.

51. In applying the dot-and-dash code to rockets, bombs, small arms, and cannon, use should be made of preconcerted signals, or of the International Code of Signals or other conventional code book. These signals are not adapted to general use with the dot-and-dash code.

Throughout, red may indicate a dot, white or green a dash. In cases where the colors of signals are not visible as may be the case, in the use of the Very pistol by day, one may indicate a dot, two fired simultaneously, a dash.

The receiving station should promptly acknowledge receipt of each message.

When a line of several stations is established, care should be taken that each station is supplied with copies of instructions and codes exactly alike.

COSTON LIGHTS.

52. These lights are made of a slow-burning composition and are usually held in a socket and displayed by hand.

ROCKETS.

53. Rockets used by the Army are of two kinds, viz, sequence rockets, showing red and white stars, and yellow-smoke rockets. With the sequence rockets there is included a dummy element. These rockets are packed in water-tight cases and are plainly labeled.

Each star burns from four to six seconds, and there is a slight interval between the visibility of each two stars. Between two or more stars of the same color, as, for instance, those indicating the letters O, S, dummies, which show no light and carry the fire to the next star to be ignited, are inserted. The letter H can not be signaled by this method.

BOMBS.

54. Bombs used by the Army are of two kinds, white or red for night use and smoke bombs for day use. They, like rocket signals, are not adapted for general use with the dot-and-dash code, but should be used with preconcerted signals, or to indicate letters of the International Code of Signals or other conventional code book. Like rockets for night signaling, the red bomb indicates a dot, the white a dash.

VERY PISTOL.

55. The Very system is used by the Navy only to transmit flag-code signals contained in the Battle or General Signal Book.

The Very pistol is a breech-loading, single-shot pistol, with an 8-inch steel barrel chambered to receive a 12-gauge commercial shotgun shell. Brass shells are used, and are packed in boxes colored to indicate an element of any alphabet or any special signal which may be desired. The stars rise to a height of about 200 feet and remain visible for some time.

The Very pistol projects red, white, and green stars for use as night and the streamer of smoke for use in daytime. The stars can readily be seen several miles at night, and the smoke streamer can be picked up by glasses for over a mile in daytime.

In making a signal the stars are projected deliberately, one by one, from the first to the last, without regard to time intervals. It is desirable, however, that the stars should be projected vertically or so as to fall in the direction of the receiver of the message, and that they should appear without very unequal intervals between them; at the same time, through some unforseen cause, a long interval may elapse between two stars of a message, but no account of this shall be taken unless the interval is prolonged to about a minute.

A star may be broken by the shock of discharge and show several stars of the same color in the air. This will be recorded as one star.

When, after waiting about one minute, the receiver of the signal sees no more signal stars, he will consider the signal finished.

SOUND SIGNALS.[1]

56. Sound signals made by the whistle, foghorn, bugle, trumpet, and drum may well be used in a fog, mist, falling snow, or at night. They may be used with the dot-and-dash code.

In applying the General Service Code to whistle, foghorn, bugle, or trumpet, one short blast indicates a dot and one long blast a dash. With the drum, one tap indicates a dot and two taps in rapid succession a dash. Although these signals can be used with a dot-and-dash code, they should be so used in connection with a preconcerted or conventional code.

58. With small arms, field, siege, or seacoast guns, one shot may indicate a dot, two shots a dash; but in this case the signals are not adapted to the general use of a dot-and-dash code, but should be employed in connection with a preconcerted or conventional code.

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[1] See also Emergency signals, Part XIII.

PART XI.

FLAG SIGNALS BY PERMANENT HOIST.

INTERNATIONAL CODE.

59. The term "flag signals" or "flag code signals," as used by the Navy, applies to signals made by hoists of flags, and should not be confused with the use of the expression by the Army to indicate what is known to the Navy as wigwag signals.

60. The only flag signals by permanent hoist and corresponding code books authorized for use by the Army are the International Code of Signals and Code List of American Vessels.

61. The International Code of Signals will be used by the Army when such use may appear desirable, as on Army transports and at seacoast fortifications, and between the Army and Navy, in accordance with recommendations of the Army and Navy Board. Sets of International Code Flags, the International Code of Signals, and the Code List of American Vessels will be issued by the Signal Corps in cases where the application therefor is approved by proper authority.

62. The International Code of Signals consists of 26 flags—one for each letter of the alphabet—and a code pennant. The flags are used in connection with the International Code Book of Signals. Explanation for the proper use of this code is given in the Code Book.

63. Night signals to boats will be made by the two-arm semaphore, torch, portable lantern, or electric system in the same manner as other signals of the Navy. In the Navy the Very system is not contemplated for signaling to boats, being too cumbersome. The electric system used should be either the Ardois or the blinker, using the dot-and-dash code for either. It is provided that boats shall acknowledge by day with the Navy code hand answering pennant, and by night with a hand lantern or torch or Very's red star.

CODE LIST.

64. The Code List of American Vessels is a publication of the Bureau of Navigation, Department of Commerce, setting forth the names of United States vessels, their flags, signal letters, official numbers, etc.

65. The General Signal Book of the Navy, being confidential, will not be issued to or used by the Army.

66. Codes to be used with rockets, bombs, etc., are not specifically included in the system agreed upon for use between the Army and Navy. They are not prescribed for use by the Navy.

67. The International Code of Signals, List of Radio Telegraph Stations of the World, and the Code List of American Vessels, with the proper code flags, will be kept on hand at radio or other coastal stations of the Army where authorized.

PART XII.

CONVENTIONAL TELEPHONE SIGNALS.

68. There are certain letters of the alphabet which are at times confused with other letters of similar sound. Such is particularly true when using the telephone. This condition gives rise to delays and errors, especially when transmitting cipher.

To provide a ready means of phonetically distinguishing similar sounding letters, the following is authorized:

A—Able	N—Nan
B—Boy	O—Opal
C—Cast	P—Pup
D—Dock	Q—Quack
E—Easy	R—Rush
F—Fox	S—Sail
G—George	T—Tare
H—Have	U—Unit
I—Item	V—Vice
J—Jig	W—Watch
K—King	X—X-ray
L—Love	Y—Yoke
M—Mike	Z—Zed

Example: If the operator receives "buy" as "vie," and difficulty is experienced in distinguishing "B" from "V," "buy" may be spelled "boy-u-y."

PART XIII.

EMERGENCY SIGNALS.

69. The following emergency signals may be employed by the Army when circumstances permit and conditions justify and when authorized by officers in immediate command of station or troops using them.

70. These signals are designed to call attention of persons within their radius, and all such persons should pay instant heed to them. They may indicate distress; ask assistance; give a general alarm in case of riot, attack, flood, or conflagration, or may be used for other urgent reasons.

Their purpose and meaning should be designated beforehand. When authorized, information regarding their meaning and use must be given to troops and other persons entitled to receive or send these signals and to all those who should be familiar with their meaning.

These signals will never be used without good cause.

EMERGENCY SIGNALS FOR USE ON CABLE AND TELEGRAPH LINES.

71. The general attention or emergency call for use on cable or land telegraph lines is the numeral "9." It will be sent out only by the proper authority and will have its meaning clearly understood. Upon hearing the call, all operators will give way, but they will remain at their instruments until relieved. They will not cut in unless called. The numeral "9" as an emergency call may be used in anticipation of attack or riot; it may be used to indicate a conflagration or other danger and should be used only in case of need. This signal is of great importance and should be thoroughly understood by all cable and telegraph operators. It should be conspicuously posted with appropriate instructions as to its meaning and use in all cable and telegraph stations.

EMERGENCY SIGNALS FOR USE IN RADIOTELEGRAPHY.

72. The radio distress signal for use at sea is the international signal SOS. It is a universal signal and is of paramount importance. Its meaning should be thoroughly understood by all radio operators, and should be conspicuously posted with appropriate instructions in all radio stations of the Army whether on ship or ashore.

73. The operator of any Army radio station aboard ship, upon receiving an SOS signal, will immediately ascertain the exact position, in latitude and longitude, of the vessel sending the signal. When this information has been received, the operator will immediately have the same delivered to the officer in charge of the ship, who will take the necessary action.

NOTICE TO BE POSTED IN ALL RADIO STATIONS.

74. The following is from the report of the International Radiotelegraphic Conference, London, 1912:

Ships in distress shall make use of the following signal:

• • • — — — • • •

repeated at short intervals, followed by the necessary particulars.

As soon as a station hears the signal of distress, it must suspend all correspondence and must not resume the same until after it has made sure that the communication consequent upon the call for help is finished.

The stations which hear a call of distress must act according to the indications given by the ship which makes the call, with regard to the order of messages or their cessation.

When, at the end of a series of distress calls, there is added the call-signal of a particular station, the reply to the call is proper to that station only, unless that station does not reply. Failing the indication of a particular station in the call for help, every station that hears the call shall be bound to reply thereto.

SIGNALS OF DISTRESS ON ARMY TRANSPORTS, AND VESSELS UNDER CONTROL OF THE ARMY.

75. The signal of distress on Army transports shall be, either together or separately, as follows:

In the daytime—

First. A gun or other explosive signal fired at intervals of about one minute.

Second. The International Code signal of distress indicated by NC.

Third. The distance signal, consisting of a square flag having either above or below it a ball or anything resembling a ball.

Fourth. A continuous sounding with any fog-signal apparatus.

At night—

First. A gun or other explosive signal fired at intervals of about one minute.

Second. Flames on the vessel (as from a burning tar barrel, oil barrel, etc.).

Third. Rockets or shells throwing standard Army transport night signals, fired one at a time, at short intervals.

Fourth. A continuous sounding with any fog-signal apparatus.

These signals require no answer, but any station hearing or seeing them should make every effort to assist the ship in distress.

On Army transports the fire signal is the continuous and rapid ringing of the ship's bell for a period of not less than 20 seconds, and this signal shall not be used for any other purpose whatsoever. An emergency or alarm signal, indicating the approach of danger from rocks, shoal water, collision, etc., is made by the rapid and continuous short blasts of the whistle.

These signals will apply, so far as practicable, to all vessels under the control of the War Department, both in peace and war.

Emergency Signals with Bombs (or Other Explosive), Small Arms, or the National Ensign.

76. A general attention or alarm signal, indicating attack, riot, conflagration, or other emergency, will be made by sound signals, when authorized as previously indicated, by one discharge of a cannon, rifle, pistol, or *smoke* bomb by day, followed by a smoke rocket at half-minute intervals. At night, by one discharge of cannon, small arm, or *light* bomb, followed by a red rocket at half-minute intervals. This signal requires no answer.

77. Used as an emergency signal it will serve to call all troops to attention, and should be followed by a preconcerted signal to indicate the character of the alarm given or to communicate instructions. As an instance, a smoke bomb followed by a rocket is a call to attention and will indicate riot or attack, upon receiving which all troops will fall into ranks under arms. Should the first rocket be followed by a second, the signal will indicate a conflagration or other danger, and all troops noting it will fall into ranks prepared to fight fire or to meet other danger (such as flood).

78. If no bombs or rockets are at hand at the camp or station for use with sound signals of this character, a general-alarm signal will be made by a rapid discharge of shots. None of these signals requires an answer.

79. With the national flag the distress signal, universally understood, is made by flying the ensign union down.

EMERGENCY SIGNALS BY SOUND WITH BELL, WHISTLE, FOGHORN, BUGLE, TRUMPET, OR DRUM.

80. General attention, distress, or alarm signals may be made by rapidly repeated strokes of the bell, blasts of foghorn or whistle, call of bugle or trumpet, or tap of drum. These signals, explained beforehand and thoroughly understood, require no acknowledgment, but should be acted upon immediately.

81. In addition to the dot and dash signals, the bugle, the trumpet, and the whistle may be used for signaling as in the Drill and Field Service Regulations of the Army.

The long roll of the drum will be recognized as an emergency signal. When used in the Army it is a general-alarm signal and requires all troops to fall into ranks.

EMERGENCY SIGNALS WITH THE VERY PISTOL.

82. The red star made and repeated with the Very pistol in quick succession as a call, without the rocket, is a signal of distress or alarm, indicating attack, shipwreck, man overboard, fire, or other emergency. It must be answered by all stations receiving the signal and requires immediate and proper attention. It is well adapted for use at seacoast stations or on transports.

83. No preconcerted emergency signals are prescribed for use with visual signals other than pyrotechnics.

84. *It is recommended that the instructions regarding emergency signals, their use and meaning, be posted in all radio and signal stations of the Army, at headquarters in garrison or in the field, at the guardhouse of military posts, at the guard tents of troops in the field, and that they be communicated as part of the instructions to officers and to soldiers on guard duty.*

PART XIV.

ADDITIONAL AND IMPROVISED CODES.

85. Other codes of signals than those herein prescribed or outlined may be useful in special work of the Army or upon unusual occasions. Of these are conventional scout signals and special signals used in action by the Army, as noted in the Field Service Regulations of the Army and in this book. In the field also, many instances will occur where it will be necessary to transmit information rapidly without recourse to the authorized equipment. At such times it will devolve upon individual commanders to improvise methods of signaling best suited to the occasion and the conveniences at hand; but such systems are temporary and exceptional, and for them no general provision can be made.

When special systems are desired for use by any arm of the service, they may be authorized upon the recommendation of the Chief Signal Officer of the Army and the approval of the Secretary of War, the request in each instance being made by the commanding officer of the organization desiring to employ them.

PART XV.

GENERAL INSTRUCTIONS FOR LOCATING AND OPERATING VISUAL SIGNAL STATIONS.

86. To select a visual signal station, choose a point perfectly in view of the communicating station; fix the exact position in which the flagman is to stand, so arranged, if possible, that when viewed from the communicating station he will have behind him a background of the same color for every position in which the signals may be shown.

87. Before communication by signals is opened, the telescope should be placed in the most suitable position for its most efficient use and shelter.

88. To determine the color of the background, first ascertain whether the communicating station is higher, lower, or level with your own. If it be higher, the background for your signals, viewed thence, will be the color of the field, woods, etc., behind and lower than your flagman. If it be lower, your background will be the color of the ground, etc., behind and lying higher than your flagman. If the stations are of equal elevation, then the background for your signals will be that directly behind the flagman.

89. Secrecy in communication is vitally important. Even though the code used is unknown to the enemy, yet the waving flag or other means of visual signaling will inform the enemy that he has probably been observed. This should be avoided, and stations located where they will be most difficult of discovery. If there is reason to believe that signals are seen by the enemy, they should be made in cipher and only upon the expressed authorization of the signal officer charged with the duties of maintenance. Extraordinary care should be taken in transmitting cipher messages, *and, where practicable, they should be repeated.*

90. The color of the flag must contrast as strongly as possible with that of the background. With green or dark, or with earth-covered background, the white flag should be used. The distant station is the best judge of background, and should it indicate the color of flag wanted, that flag should be used.

91. Avoid, if you can, a station where a camp is located between it and the distant station, as the intervening lights will cause annoyance and delay.

92. Complete visibility of stations being provided, stations should be so located that messages may be readily carried to them. Do not establish stations far from commonly-traveled roads, unless there be reasons in the physical contour of the country or otherwise for such locations.

93. The following table shows the extent of horizon for different heights above the sea level; that is, it shows how far an object at the sea level can be seen.

Height of the eye above sea level (in feet).	Distance (in statute miles).	Height of the eye above sea level (in feet).	Distance (in statute miles).
10	4	115	14
15	5	130	15
20	6	150	16
30	7	200	18
40	8	230	20
50	9	300	23
60	10	350	25
70	11	500	30
85	12	700	35
100	13	900	40

94. Hence, an observer whose eye is 30 feet above the sea can distinguish an object 7 miles distant, providing it is at the sea level; but if the object is itself 15 feet above the sea he can make it out 7+5=12 miles off.

95. To find a signalman near any known station, note with the unaided eye some prominent landmark near which the looked-for person or object is supposed to be, and direct the telescope upon the place; if the eye is placed at the eyeglass of the telescope,

the prominent or directing landmark will be found in the field of view. It will be easy then to scale the country near the marker until the signalman is found. When the compass bearing of the object sought for is known, the telescope may be aligned by a line drawn with the proper compass bearing. Commencing then with the view at the horizon, the telescope is slowly moved from side to side, taking in fresh fields of view each time a little nearer the observer, until the whole country shall have been observed from the horizon to quite near the station. When the direction only of the object can be given, and it is sought for, the whole landscape in that direction to the horizon should be divided into sections by imaginary lines, the limits of these sections being bounded between visible landmarks through which the bounding lines are supposed to pass. Each section should be scrutinized little by little, until the glass has been passed over every spot. Such search will seldom fail to be successful.

96. The magnetic bearing of all stations with which another station has to work should be carefully noted and recorded in the office directly concerned. In addition, guide lines may be established by driving two stakes firmly into the ground and close to each other. A prolongation of a line through the center of one stake and marked on the adjacent one will strike the distant station. Under each line should be written the name of the station which it marks.

97. A signal officer should provide himself and the persons working under him with the latest and most accurate topographic maps of the country in which the Army is operating. He should familiarize himself with and instruct his subordinates as to the location of each signal station, so that information can be promptly transmitted. He should have a list of the "calls" of each office and the personal signal of each man under his jurisdiction.

98. The person in charge of a station is responsible for the discipline of his party.

99. Daily inspection should be made to insure that all signaling instruments, appliances, and material are in readiness for instant use.

100. Signal rockets, bombs, and other pyrotechnics, should be packed in waterproof chests or pouches and carefully guarded from moisture. Whenever there are indications that they have been

affected by moisture, they must be fully aired and thoroughly dried.

101. Whenever one's station call is observed, the called station should at once respond, making at the close of the response the particular signal by which it is identified.

102. The calling station should at intervals when calling give its own call or signal.

103. Strict and entire attention should be required of each man connected with a station, and no persons should be allowed to loiter around or within hearing of the words called out to the signalman.

104. Assignment of men will be made so that a continuous watch for signals may be kept and responsibility for neglect to promptly answer calls determined.

105. When a station has sent all messages on hand, the signal "Cease signaling" should invariably be made. When nothing more is to be sent from either station, both will make "Cease signaling."

106. If a signal station asks another to move its station either to its right or left, so that its signal will be more distinct, each station will see that a signalman holds a flag or lighted torch above his head. The station asking for the change will lower its flag immediately upon the distant station arriving at a position with a good background.

107. Signalmen upon stations will examine, from time to time, every prominent point within signal distance to see if communication is attempted therefrom.

108. Attempts to attract the attention of a station, in order to be successful, must be persistent. They should never be abandoned until every device has been exhausted, and they should be renewed and continued at different hours of the day and night.

109. During the time that signals are being made to attract attention, the calling stations must watch closely with a telescope the station called, not relaxing its efforts until communication is established or the station ordered abandoned.

110. Stations for use with either visual or sound signals should be so placed as to avoid exposure to an enemy. On the other hand, they should be so placed as to be as readily accessible as practicable to those entitled to use them.

Part XVI.

TELEGRAPH CODE BOOKS AND CIPHERS.

The Telegraph Code Book.

111. A code book is a collection of arbitrary words or groups of letters to each of which some ordinary word, proper name, phrase, or sentence is assigned as a meaning.

112. Ciphers embrace all means whereby writings may be transcribed in occult terms. All ciphers employ some distinct method for transcription, which method is termed a key. In practice the key is usually applied directly in enciphering and reversed in deciphering messages.

113. The code books of the commercial telegraph companies are examples of well-known codes suited to general use. Besides these, many special codes have been formulated which embody technical expressions especially adapted to a particular use.

114. A War Department Telegraph Code is now in use, adapted to the special needs of the military establishment in peace and war, which contains but five letters to a word, as required by the present rules of commercial telegraph companies, who have decided that code words, other than dictionary words, over land lines shall not consist of more than five letters each, although for transmission over commercial submarine cables any two five-letter code words may be combined to form and be counted as one code word. Words so combined for economy are separated for decoding.

115. Code books are intended for economy and to insure secrecy. When used solely for economy, the message is said to be in plain code—that is, the words or phrases of the message are coded by direct reference to their respective code equivalents. The plain code is readily translated by reference to a code book. When secrecy is desired, however, some method of enciphering is employed which can be translated only by the use of a key.

116. Ciphers are nearly infinite in number and vary greatly in complexity. Probably no one is absolutely unreadable, but even the simplest cipher has the advantage of delaying the reading of

the message and of requiring more or less expertness in use, hence the value of ciphers in the military service. The only cipher codes necessary to consider here are those obtained by the use of the cipher disk and the route cipher

The Cipher Disk.

117. The cipher disk is a simple but useful device for disguising the meaning of a message; it is composed of a circle of cardboard, celluloid, or other material revolving upon a card. The alphabet, reading from left to right, is printed on the card in upper-case letters. On the circle is printed the alphabet, reading from right to left, in lower-case letters.

118. If it is desired to encipher a message, the key letter or the first letter of the key word or words is set opposite "a." Let us assume it to be "E." The cipher letters to be written are those opposite the text letter when the letter "a" on the circle is set opposite "E" on the card. For example, "Send powder," would be written "marb pqiban." Numbers when enciphered with the cipher disk must be spelled out.

119. Having a cipher disk as above described, this mere transposition of letters would delay but a short time the deciphering of a message by one not knowing the key letter, as it would be necessary only to place, in turn, opposite "a," each of the letters of the alphabet, beginning with "B," and noting the letters opposite the enciphered letters. But this simple disk can be used with a cipher word, or, preferably, cipher words, known only to the correspondents, and it is entirely improbable that a message so enciphered could be deciphered in time to be of any value to the enemy. Using the key words " permanent body " to encipher the message "Reenforcements will reach you at daylight," we would proceed as follows: Write out the message to be enciphered and above it write the key word or key words, letter over letter, thus:

PERMANENTBODYPERMANENTBODYPERMANENTB
reenforcementswillreachyouatdaylight
yanzvznlppkqfxijbpwanruqpeplomccwhmi

120. Now bring the "a" of the circle under the first letter of the key word on the card, in this case "P." The first letter of the message to be enciphered is "R"; "y" is found to be the letter con-

nected with "R;" and it is put down as the first cipher letter. The letter "a" is then brought under "E," which is the second letter of the key word. "E" is to be ciphered and "a" is found to be the second cipher letter. Then bring "a" to "R" and the cipher letter "n" will represent "E," the third text letter of the message. Proceed in this manner until the last letter of the cipher words is used, and, beginning again with the letter "P," so continue until all letters of the message have been enciphered. Divided into groups of five letters, it will be as follows: "yanzv znlpp kqfxi jbpwa nruqp eplom ccwhm i."

EMPLOYMENT OF CIPHER DISK.

121. If messages are enciphered by a mere transposition of the letters of the alphabet, the cipher disk can be used to quickly decipher the message, as the following example will show: Assume that "a" is used to represent "F," "b" to represent "E," "c" to represent "D," "d" to represent "C," "e" to represent "B," etc., in regular sequence, and that the message to be enciphered is: "We are short of rifle ammunition; send 20,000 rounds at once."

122. This would be enciphered, if divided into groups of five letters, as follows: "jbfob nyrom raoxa ubftt lsxmx rsnbs cmjbs mhmyr lnfsc orlsc nfmrs db."

123. Place "a" of the circle opposite "B" of the card and notice whether the cipher letters "jbfob"—the first group—are intelligible. They give "SAWNA"; continue this, for "SAW," the first three letters may be the text word. Now, the next group is "nyrom," and these give "ODKNP." We know that "a" does not represent "B" because the first 10 cipher letters give the meaningless letters "SAWNAODKNP." Turn "a" to "C" and we have the first group "TBXOB," which is without meaning. Turning "a" to "D" we get "UCYPC," a meaningless jumble. Turn "a" to "E" and we get "VDZQD," which is meaningless. Now turn "a" to "F" and we find that "jbfob" means "WEARE," which gives us the two words "We are." We continue to the next group, "nyrom," which gives us "SHORT." We now have these letters "WEARESHORT," which at a glance we read "We are short." It would appear that we have now found the key letter, and after deciphering several additional groups we are confirmed in this belief and the information hidden in the cipher is ours.

Continue deciphering with "a" opposite "F" until the end of the message. Sometimes the key letter is changed after two, three, or four letters. It is a matter of minutes only to run through the alphabet and learn the meaning of a message so enciphered.

IMPROVISED SUBSTITUTE FOR CIPHER DISK.

124. Cut vertical strips, each about one-half inch wide, from lined writing paper. Paste these end to end so that two strips will be made up, one with 26 spaces and the other with 52 spaces. Write the alphabet twice, beginning with letter "A," down the 52-spaced strip, and write it once backwards, beginning with letter "Z," down the 26-spaced strip. These two strips, when laid side by side, may then, by sliding the 26-spaced strip up and down to the appropriate letter on the 52-spaced strip, be made to perform the functions of a cipher disk. Strips cut from blanks of the field message book and pasted end to end will serve conveniently for improvising this substitute, the letters being written in the small squares on the backs of the strips.

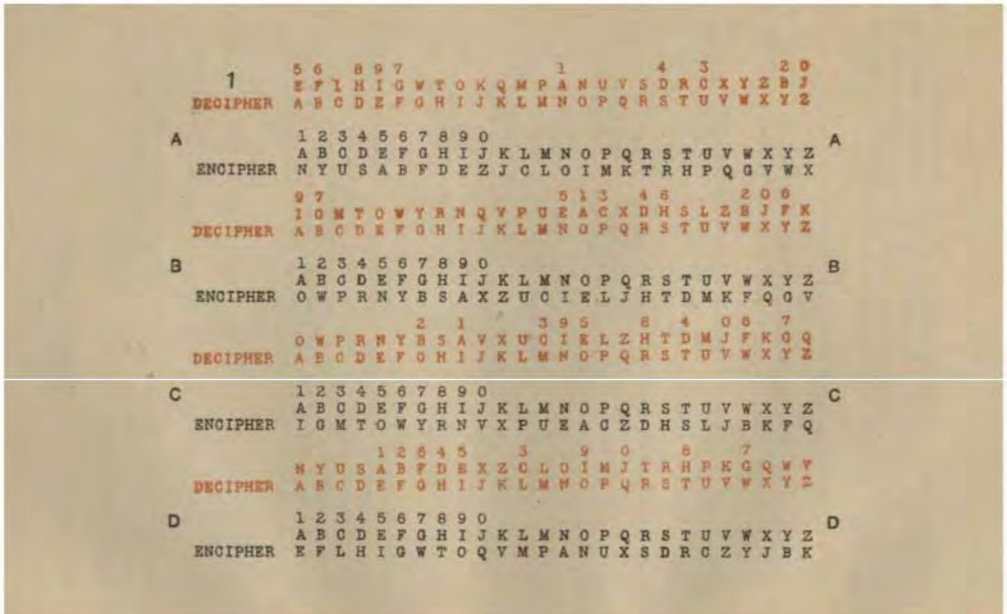
AN OPERATORS' CIPHER.

125. This cipher may be used in radio work for enciphering for transmission the name of the sending detachment, its location, the date and hour, the tactical number, the address, and the signature of the message.

126. The cipher comprises four cipher alphabets which are identified by the letters A, B, C, and D. The operator putting these parts of the message in cipher may use, at will, any one of these four alphabets and indicate to the receiving operator which one has been used by sending the indicating letter as the first letter of the first cipher group.

127. For example, suppose the following is to be sent by radio: "From Patrol 27th Infantry; At Weston, Mo.; Date May 19, 1915; Hour 8.30 a. m.; No. 2; To Comdg. Officer 27th Inf., Ft Leavenworth, Kas; (body of message); Jones, Sgt." This would actually be sent, if not put in cipher, "Fm Patrol 27th Infantry at Weston Mo 19 ho 8 30 AM No 5 to Comdg Officer 27th Inf Ft Leavenworth Kas (body of message) Jones Sgt."

128. To encipher this message, it would first be written in the following form. Note that the first group contains but *four* letters


1
DECIPHER
5 6 8 9 7 1 4 3 2 0
E F I H I G W T O K Q M P A N U V S D R C X Y Z B J
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
A
1 2 3 4 5 6 7 8 9 0
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
ENCIPHER
N Y U S A B F D E Z J C L O I M K T R H P Q G V W X
9 7 5 1 3 4 6 2 0 6
I G M T O W Y R N Q V P U E A C X D H S L Z B J F K
DECIPHER
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
B
1 2 3 4 5 6 7 8 9 0
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
ENCIPHER
O W P R N Y B S A X Z U C I E L J H T D M K F Q G V
2 1 3 9 5 8 4 0 6 7
O W P R N Y B S A V X U C I E L Z H T D M J F K G Q
DECIPHER
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
C
1 2 3 4 5 6 7 8 9 0
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
ENCIPHER
I G M T O W Y R N V X P U E A C Z D H S L J B K F Q
1 2 6 4 5 3 9 0 8 7
H Y U S A B F D E X Z C L O I M J T R H P K G Q W V
DECIPHER
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
D
1 2 3 4 5 6 7 8 9 0
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
ENCIPHER
E F L H I G W T O Q V M P A N U X S D R C Z Y J B K

because we want to send the indicating letter of the cipher used as the first letter of this group. Also note that all cipher work should be done with capital letters to decrease the liability of errors.

FMPA TROL2 7THIN FANTR YATWE STONM O19HO 8 30AM

NO5TO COMDG OFFIC ER27T HINFF TLEAV ENWOR THKAS JONES SGTXQ.

129. We will suppose the operator decides to use alphabet C. He will write C as the first letter of the first group under the plain text. Now, using the black alphabet and reading down, F of the plain text is enciphered by W, M of the plain text by U, etc., and we have, noting that the numbers, where they occur, are enciphered by the corresponding letters:

FMPA	TROL2	7THIN	FANTR	YATWE
CWUCI	SDAPG	YSRNE	WIESD	FISBO
STONM	O19HO	8 30AM	NO5TO	COMDG
HSAEU	AINRA	RMVIU	EAOSA	MAUTY
OFFIC	ER27T	HINFF	TLEAV	ENWOR
AWWNM	ODGYS	RNEWW	SPOIJ	OEBAD
THKAS			JONES	SGTXQ
SRXIH			VAEOH	HYSKZ

The message as sent will be:

CWUCI SDAPG YSRNE WIESD FISBO HSAEU AINRA RMVIU EAOSA MAUTY AWWNM ODGYS RNEWW SPOIJ OEBAD SRXIH (body of msg.) VAEOH HYSKZ

130. The receiving operator will reverse these steps in deciphering the message, noting that he uses the red alphabet and reads up.

TO ENCIPHER FOR TRANSMISSION.

131. When the message is handed to you for transmission, note time received as usual. Then, on the back, print in capitals everything between the check and the body of the message, using the exact form in which it would be transmitted if not in cipher. Also

print the signature. In printing, make the first group *four* letters and thereafter groups of five letters each. Complete the last group before the body of the message and the last group of the signature, if these have less than five letters, by adding XQK, etc., at will. Now take one of the cipher alphabets, say cipher C, and, writing C as the first letter of the first cipher group, proceed to encipher the matter as copied on the back. Use the black alphabet on the cipher card and read down to get the corresponding cipher letter for each letter or figure of the text. Write the cipher matter immediately under the plain text. The result will be a number of cipher groups all containing five letters each. Count these groups and the number of words in the *body* of the message. The total is the check. Enter it with other office marks in the usual way.

TO TRANSMIT THE MESSAGE.

132. Send as usual to include the check. Then turn message over and send the cipher groups of the place from, etc., and address, followed by double dash. Then turn over and from the original message send body of message followed by double dash. Then turn over and send cipher groups representing the signature. Follow by AR and K or by another message if one is ready. The receiver will count all cipher groups and the words in the body of message, and if this agrees with check he will give you R as usual. Look for him at once as he does this before deciphering the cipher groups, and it ought to take no longer than counting check of an ordinary message.

INFORMATION FOR THE SENDER OF A MESSAGE.

133. It is not the duty of the operator to put the *body* of the message in cipher or code. The sender must be the judge of the necessity for this procedure, and must, if he deems it necessary, put it into his own code or cipher before presenting it for transmission.

TO RECEIVE AN ENCIPHERED MESSAGE.

134. Copy everything, including the check, as usual. Then turn over message blank and duplicate, and, on the back of the duplicate, copy in capitals the cipher group of five letters each until you get the double dash. Then turn back the message blank and duplicate

onto the carbon and take, in the usual way, the body of the message up to the double dash. Then turn over blank and duplicate as before and copy in capitals on the back of the duplicate the cipher groups representing the signature. After receiving AR and K, count the number of five-letter groups and the number of words in the body of the message. The total should agree with the check, and, if so, you may give R as usual. Note that your cipher groups must all consist of five letters.

TO DECIPHER THE CIPHER GROUPS.

135. The first letter of the first group received will be A, B, C, or D, indicating which cipher alphabet has been used by the sending station. Using the red alphabet indicated and working upward, write the letter or numeral of the plain text over the corresponding cipher letter. There will be no difficulty, as a rule, in deciding where you should put in numerals and the word forms will be evident at once. Now copy the deciphered matter in the usual place on the message blank and duplicate, and message will be ready for delivery. The duplicate will retain all your work and is a complete record of the message.

DISAGREEMENT AS TO CHECK.

136. If the check of the receiver does not agree with the transmitted check, the receiver, instead of giving R, will send "check" and the initial letters of each cipher group and each word of the body of the message. The sender should be able to determine at once what word was not received and should send the preceding and following word as well as the missing word to correct the check.

ALTERNATIVE METHOD.

137. Furnish all stations with blank paper the size of the message blank. The transmitting station will do the enciphering on one of these sheets instead of on the back of the message and send the cipher part from this sheet. This sheet will be attached to the original message for file.

The receiving station will copy the cipher part on one of these sheets and do the deciphering work on it. The result will be copied on the regular blank containing the cipher groups and the deciphering will be attached to the duplicate for file.

The Route Cipher.

139. This is a cipher in which the words of a message are retained unchanged, but are so disarranged by preconcerted rules that the sense becomes unintelligible. The message as received seems to be a number of disconnected words without meaning, but by arrangement in proper order in accordance with certain rules can be easily read. Messages enciphered in this manner may be translated by persons not in possession of the key, and therefore the information contained therein should *only be of such a character as to be of little value to the enemy unless acted upon immediately.* The usual method employed in arranging a message for this cipher is to write the words in vertical columns. The number of words in each column should always equal the number of columns, being made so, if necessary, by the addition of sufficient "blind" words. A preconcerted route is agreed upon, as up the first column, down the third, up the second, etc. The message is then transmitted without reference to the columns, but is deciphered at the receiving station by column arrangement and perusal along the original route.

140. For example, to encipher the message "Move daylight. Enemy approaching from north. Prisoners say strength one hundred thousand. Meet him as planned," arrange as follows:

Move	strength	planned	say
daylight	one	as	prisoners
enemy	hundred	him	north
approaching	thousand	meet	from

141. Here the route is down the first column, up the fourth, down the second, and up the third.

PART XVII.

THE FIELD MESSAGE.

142. The term "field message" is applied to all messages sent over field lines of information. All field messages for transmission over field lines of information by electrical or visual means should be plainly written by the sender on the blank forms in the Field Message Book. The practice of verbally delivering telegrams to enlisted men for transmission should invariably be discouraged.

143. In framing telegrams, all words not important to the sense will be omitted. The last name of the officer addressed, or his title, and the last name of the sender, are generally sufficient (A. R., par. 1188). Proper names in any part of the message should be written or printed in ROMAN CAPITALS, thus: SMITH, TOLEDO, MAUMEE ROAD.

144. The Field Message Book issued by the Signal Corps contains 50 message blanks with duplicate tissue sheets and two sheets of carbon paper. Proper instructions for their use are printed on the cover of the Field Message Book, as shown in Part XXI of this book.

PART XVIII.

INFANTRY COMPANY SIGNAL FLAGS.

145. The following is from the Infantry Drill Regulations, United States Army, 1911:

146. The signal flags described are carried by the company musicians in the field. In a regiment in which it is impracticable to make the permanent battalion division alphabetically, the flags of a battalion are as shown; flags are assigned to the companies alphabetically, within their respective battalions, in the order given.

First battalion:
- Company A. Red field, white square.
- Company B. Red field, blue square.
- Company C. Red field, white diagonals.
- Company D. Red field, blue diagonals.

Second battalion:
- Company E. White field, red square.
- Company F. White field, blue square.
- Company G. White field, red diagonals.
- Company H. White field, blue diagonals.

Third battalion:
- Company I. Blue field, red square.
- Company K. Blue field, white square.
- Company L. Blue field, red diagonals.
- Company M. Blue field, white diagonals.

147. In addition to their use in visual signaling, these flags serve to mark the assembly point of the company when disorganized by combat, and to mark the location of the company in bivouac and elsewhere, when such use is desirable.

148. For communication between the firing line and the reserve or commander in rear, the signals shown in paragraphs 41, 42, and 43 are prescribed. In transmission, their concealment from the enemy's view should be insured. In the absence of signal flags the headdress or other substitute may be used.

COMPANY SIGNAL FLAGS

INFANTRY

FIRST BATTALION

SECOND BATTALION

THIRD BATTALION

MILITIA AND VOLUNTEERS.

FIRST BATTALION

SECOND BATLN. THIRD BATLN.

PART XIX.

VISUAL SIGNALING EQUIPMENT.

THE WAND.

149. The wand is a stick of light wood about 18 inches long and one-half inch in diameter. It is held loosely between the thumb and forefinger and waved rapidly to the right or left to indicate the elements of the alphabet. It is used for practice purposes, and the signals made by it are only intended to be read at very short distances. Its effectiveness may be increased by tying a handkerchief near the outward end.

FLAG KITS, GENERAL SERVICE AND SEMAPHORE.

150. Three kinds of flag kits are issued by the Signal Corps for use with the General Service Code and the Two-arm Semaphore Code; the combination, standard, 2-foot kit; the combination infantry, 2-foot kit; and the standard 4-foot kit.

151. The combination, standard, 2-foot kit.—The combination, standard, 2-foot kit consists of 1 case, canvas; 1 staff, 3-joint; 1 flag, red, white square; 1 flag, white, red square; 2 staffs, semaphore; and 2 flags, semaphore, standard. The red flag is made of red galatea, 2 feet square, with an 8-inch white center. The white flag is of similar size and material, the only difference being an alternation of colors in the body and center. The means of attachment to the staff consists of a loop at the center and two ends of white tape at each edge of the back of the flag body. The staff for these flags is made of hickory in three joints, each joint being 23 inches long, and is assembled by means of a brass screw ferrule. Brass eyes are provided on the first and second joints to receive the tape ends at the edge of the flag. The semaphore flags are 18 inches square, divided diagonally into two parts, one of red and the other white, the red portion constituting the upper half of the flag. The staffs are

24 inches long. The carrying case is of convenient size and shape to carry the flags and staffs above enumerated and is bound with leather and fitted with shoulder straps.

152. The combination infantry, 2-foot kit.—The combination, infantry, 2-foot kit is essentially the same as the combination, standard, 2-foot kit, except that 1 infantry flag, as prescribed by paragraph 183, is substituted for the two 2-foot red and white flags above described.

153. The standard 4-foot kit.—The standard 4-foot kit consists of 1 case, canvas; 1 staff, 3-joint, and 1 flag, red, white square; and 1 flag, white, red square. The flags are 3 feet 9 inches square, with 12-inch centers, and the staffs are considerably heavier than those of the standard 2-foot kit, each joint being 36 inches long. The 4-foot kit is the standard field flag kit, and the range at which signals can be exchanged with it depends on a variety of factors, such as conditions of the weather, the location of stations, the proficiency of signalmen, etc. The speed for continuous signaling is seldom greater than five to six words per minute.

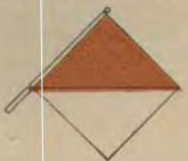
154. Powers and limitations of flag signaling.—The advantages which may be claimed for this method of signaling are portability of apparatus, adaptability to varied weather conditions, and great rapidity of station establishment. The disadvantages are the lack of celerity of the signals, their impenetrability to dust or smoke, and the comparatively short ranges at which they can be read. These ranges vary with the background, light, vision, and power of glasses if used.

155. Care of flag material.—Signal flags should be examined at the close of drill or practice and repairs made to any rents or loose ties discovered. Flags, when soiled, should be throughly washed and dried in the sun. Signals made by clean flags are much more easily read than those made by dirty ones. Staffs should be handled with care, especially when jointing or unjointing. Care should be taken not to bruise the ends of the brass ferrules. Ferrules fitting together so loosely as to permit separation of the joints in signaling must not be hammered or jammed. but should be tightened by wrapping one cr more thicknesses of thin paper around the one which is inserted in the other. If a ferrule becomes loose on a staff it should be tightened without delay.

SIGNAL CORPS TWO FOOT FLAGS

SIGNAL CORPS FOUR FOOT FLAGS

SEMAPHORE HAND FLAGS



THE HELIOGRAPH.

Description.—The complete heliograph consists of:

1 sole-leather pouch with shoulder strap containing:
  1 sun mirror } inclosed in a wooden box.
  1 station mirror }
  1 shutter.
  1 sighting rod.
  1 screw driver.
1 small leather case sliding by two loops upon the strap of the pouch containing:
  1 mirror bar.
1 skeleton leather case containing:
  2 tripods.

The mirrors are of plate glass, 4½ inches square. The sun mirror has a paper disk covering the unsilvered spot in its center. The shutter is 6½ inches square, has six leaves, operated by a key; and the key bar is provided with a stop to regulate the adjustment. The two tripods are alike, so that the mirror bar or shutter may be fitted to either, and each has a hook to which a weight may be suspended for stability.

Assembling.—There are two ways of assembling the heliograph, and the position of the sun is the guide in determining which of the two should, in any given case, be employed. When the sun is in front of the operator (that is, in front of a plane through his position at right angles to the line joining the stations) the sun mirror only is required; with the sun in rear of this plane both mirrors should be used. With one mirror the rays of the sun are reflected directly from the sun mirror to the distant station; with two mirrors, the rays are reflected from the sun mirror to the station mirror, and thence to the distant station.

With one mirror.—Firmly set one of the tripods upon the ground; attach the mirror bar to the tripod; insert and clamp in the sockets of the sun mirror and sighting rod, the latter having the disk turned down. At a distance of about 6 inches, sight through the center of the unsilvered spot in the mirror and turn the mirror bar, raising or lowering the sighting rod until the center of the mirror, the extreme point of the sighting rod, and the distant station are accurately in line. Firmly clamp the mirror bar to the tripod, taking care not to disturb the alingment, and turn up the disk of

the sighting rod. The mirror is then moved by means of the tangent screws until the "shadow spot" falls upon the paper disk in the sighting rod, after which the flash will be visible at the distant station. The "shadow spot" is readily found by holding a sheet of paper or the hand about 6 inches in front of the mirror, and should be constantly kept in view until located upon the disk. The screen is attached to a tripod and established close to, and in front of, the sighting disk in such a way as to intercept the flash.

With two mirrors: Firmly set one of the tripods on the ground; clamp the mirror bar diagonally across the line of vision to the distant station; clamp the sun mirror facing the sun to one end of the mirror bar and the station mirror facing the distant station. Stooping down, the head near and in rear of the station mirror, turn the sun mirror by means of its tangent screws until the whole of the station mirror is seen reflected in the sun mirror and the unsilvered spot and the reflection of the paper disk accurately cover each other. Still looking into the sun mirror, adjust the station mirror by means of the tangent screws until the reflection of the distant station is brought exactly in line with the top of the reflection of the disk and the top of the unsilvered spot of the sun mirror; after this the station mirror must not be touched. Now step behind the sun mirror and adjust it by means of the tangent screws so that the "shadow spot" falls upon the center of the paper disk on the station mirror. The flash will then be visible at the distant station. The screen and its tripod are established as described in the single mirror assembling.

Alternate method with two mirrors.—Clamp the mirror bar diagonally across the line of vision to the distant station, with the sun mirror and the station mirror approximately facing the sun and distant station, respectively.

Look through small hole in sun mirror and turn the station mirror on its vertical and horizontal axes until the paper disk on the station mirror accurately covers the distant station.

Standing behind sun mirror, turn it on its horizontal and vertical axes by means of the tangent-screw attachments until the shadow spot falls upon the paper disk on station mirror.

Adjustment.—Perfect adjustment is maintained only by keeping the "shadow spot" uninterruptedly in the center of the paper disk, and as this "spot" continually changes its position with the apparent movement of the sun, one signalman should be in con-

stant attendance on the tangent screws of the sun mirror. Movement imparted by these screws to the mirror does not disturb the alignment, as its center (the unsilvered spot) is at the intersection of the axes of revolution. Extra care bestowed upon preliminary adjustment is repaid by increased brilliancy of flash. With the alignment absolutely assured and the "shadow spot" at the center of the disk, the axis of the cone of reflected rays is coincident with the line of sight and the distant station receives the greatest intensity of light. Remember the distant observer is unquestionably the better judge as to the character of the flash received; and if, therefore, adjustment is called for when the "shadow spot" is at the center of the disk, the alignment is probably at fault and should be looked after at once. In setting up the tripods always see that the legs have a sufficient spread to give a secure base, and on yielding soil press firmly into the ground. Keep the head of the tripod as nearly level as possible and in high wind ballast by hanging a substantial weight to the hook. See that the screen completely obscures the flash; also that the flash passes entire when the screen is opened. This feature of the adjustment is partially regulated by the set screw attached to the screen frame. The retractile spring should sharply return all the leaves of the screen to their normal positions when the key is released. Failure to respond promptly is obviated by strengthening or replacing the spring.

Operation.—It is of the utmost importance that uniformity in mechanical movement of the screen be cultivated, as lack of rhythm in the signals of the sender entails "breaks" and delay on the part of the receiver. Dark backgrounds should, when practicable, be selected for heliograph stations, as the signals can be most easily distinguished against them.

To find a distant station, its position being unknown, reverse the catch holding the station mirror and with the hand turn the mirror very slowly at the horizon over the full azimuth distance in which the distant station may possibly lie. This should be repeated not less than twice, after which, within a reasonable time, there being no response, the mirror will be directed upon a point nearer the home station and the same process repeated. With care and intelligence it is quite probable that, a station being within range and watching for signals from a distant station with which it may be desired to exchange messages, this method will rarely fail to find the sought-for station.

The exact direction of either station searching for the other being unknown, that station which first perceives that it is being called will adjust its flash upon the distant station to enable it when this light is observed to make proper adjustments. If the position of each station is known to the other, the station first ready for signaling will direct a steady flash upon the distant station to enable the latter to see not only that the first station is ready for work but to enable the distant station to adjust its flash upon the first station.

Smoked or colored glasses are issued for the purpose of relieving the strain on the eyes produced by reading heliograph signals.

Care of apparatus.—Minor parts of the instrument should be dismounted only to effect repairs, for which spare parts are furnished on requisition. Steel parts should be kept oiled and free from rust. Tangent screws and bearings should be frequently inspected for dust or grit. Mirrors should invariably be wiped clean before using. In case of accident to the sun mirror, the station mirror can be made available for substitution therefor by removing the paper disk. If the tripod legs become loose at the head joints, tighten the assembling screws with the screw driver.

Powers and limitations of the heliograph.—Portability, great range, comparative rapidity of operation, and the invisibility of the signals, except to observers located approximately on a right line joining the stations between which communication is had, are some of the advantages derived from using the heliograph in visual signaling.

The principal disadvantages result from the entire dependence of the instrument upon the presence of sunlight and that when within range it is an attractive target. The normal working range of the heliograph is about 30 miles, under favorable circumstances, though instances of its having attained ranges many times greater than this are of record. The heliograph can be depended upon to transmit from 5 to 12 words per minute.

THE ACETYLENE LANTERN.

The signal lantern is an instrument designed for the purpose of transmitting signals by means of intermittent flashes of artificial light. It is the standard night visual signaling equipment furnished by the Signal Corps and depends for its illumination upon an acetylene gas flame.

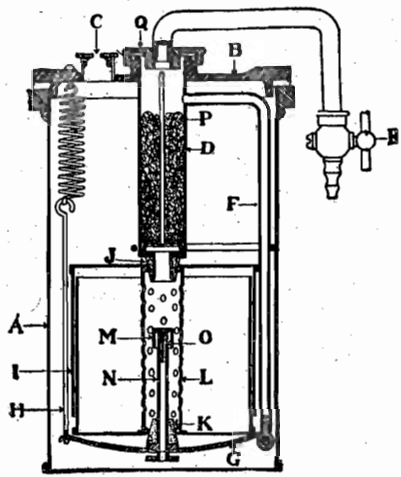
Description.—The complete equipment consists of the following:

1 lantern.
1 generator.
1 tube, rubber.
2 burners (extra).
1 cover glass (extra).
3 cartridges, carbide.
1 pliers, gas, pair.
1 white lead, tube.
1 screw driver.
1 wooden carrying case with strap.

The *lantern* is made of brass. It is provided with an aplanatic lens mirror, 5 inches in diameter, and with a focus of about 3 inches.

The base of the lantern contains a valve operated by a telegraph key which controls the main gas supply from the generator to the burner.

There is also a by-pass, with a screw adjustment, which provides the burner with gas enough for a continuous flame which can be made too low to make a signal but ignites the gas from the main supply when the key is depressed. A 3/4-foot burner is used, which produces a flame of about 35 candlepower and a projected light of about 1,900 candlepower.



Signal lantern generator.

The *generator*, made of brass, is of the water-feed type. Attached to the inside of the removable top is a frame with a flexible spring latch which holds the carbide cartridge.

The *carbide cartridge* consists of a tin-plate cylinder having a circular opening in each end, and a cylinder of wire mesh connecting these openings. The can holds 5 ounces of coarse calcium carbide, which fills the space outside the wire mesh.

The figure on the preceding page gives a sectional view of the generator with the cartridge in place.

D F G H represent the valve frame and *I* the cartridge attached. The reservoir *A* is filled with water, and when the frame is immersed, with the valve *R* closed, the air contained in the cartridge and tubing can not escape, the water seal preventing, while the confined air prevents the water from rising in the tube *N*. When the valve at *R* is opened and the air is allowed to escape, part of the water from the reservoir rises into the tube *N* and then out through the small hole *O* to the carbide. Gas is immediately generated, the pressure of which prevents further ingress of the water from the tube *N*, and the generation of gas is suspended.

225. As the gas passes out through the valve at *R* the pressure decreases, permitting the water to again rise in the tube and flow through *O*. Gas is again generated, which at once exerts its pressure and cuts off the supply of water. This is the automatic action by which water is brought in contact with the calcium carbide. Thus it will be observed that the use or escape of the gas regulates the generation by the simple device of the rise and fall of a water column. There is a cap *M* screwed over the tube *N*. This is used to deflect the course of the water downward, so that the carbide in the lower part of the cartridge is first attacked. There is a needle inside of cap *M*, which can be used for cleaning the hole *O*. When the gas is generated it passes through the filter *D* on its way to the burner through *R*. This filter consists of a tube loosely packed with absorbent cotton *P*, which should never cover the escape pipe leading to the valve *R*. In passing through this filter moisture and dust are removed from the gas.

The escape pipe *F* provides a means for the escape of gas generated and not used, or generated more rapidly than consumed. Should an excess be generated, it passes down through the tube *F*, and, finding its way through some small holes in the bottom of this tube, escapes through the water seal and the opening at *C*. The principal things to observe in the operation of this generator are the following:

(1) To see that the rubber plugs *K* and *J fit tightly* into the openings of the cartridge.

(2) That the tube *N*, the cap *M*, and the water hole *O* are not stopped up.

(3) That the cotton in the filter is changed frequently.

(4) That the *stopcock R is closed before inserting the frame in the water*. If this latter instruction is not complied with, it can be readily seen that the water will have free access to the carbide and excessive generation will occur.

When the charge is exhausted, the entire cartridge is taken out and thrown away. This eliminates the handling of carbide and the disagreeable task of cleaning out the residuum after the gas has been extracted.

Connection is made from the stopcock *R* to the hose connection on the lantern proper, and this is the passageway of the gas from the generator to the burner.

One charge of calcium carbide will supply gas to burn about one hour with the light turned on full, or for approximately three hours' signaling.

Complete instructions for the operation and care of this instrument are issued with it.

Powers and limitations of the acetylene signal lantern.—As conditions are usually more uniform at night than in the daytime, the signal lantern is probably with the exception of the searchlight the most reliable of all means of visual signaling. The advantages of this apparatus are its portability, speed of operation, and comparatively great range. The principal disadvantages are due to the interference caused by rain, fog, and moonlight. The speed attainable with the lantern is about the same as that attainable with the heliograph. In emergency, and for distances not exceeding $\frac{1}{2}$ to $\frac{3}{4}$ mile, the lantern can, on dark or cloudy days, be employed for day signaling. These lanterns have been tested up to a distance of 10 miles with the naked eye, and under favorable conditions can be used over a range somewhat in excess of this. With a 30-power telescope the flash can be read a distance of 30 miles.

PART XIX.

FIELD MESSAGE BOOK, U. S. ARMY.

Signal Corps Form No. 217 A, 1916.

INSTRUCTIONS FOR OPERATORS.

1. This blank will be used for field messages, both sent and received.

2. The *sending* operator will enter the time, *when the message is handed him for transmission*, in the space after the words "time filed." He will enter in the proper places, at the head of the blank, the number of the message, the call letter of his station, with his personal signal, the check (number of words or groups of cipher contained in message, *counting address and signature*), and, after "O. K." has been received, he will enter the time the message was sent, and the call letter of the receiving station, with the personal signal of the receiving operator.

3. To transmit a message in American Morse the operator will send (1) the number of the message and call letter of his station; (2) his personal signal; (3) the check; (4) "fm," followed by the name of the sending detachment; (5) "at," followed by the location of the sending detachment and date; (6) "ho," followed by the hour (a. m. or p. m.) message was written; "No." (sender's serial number); (7) "to," followed by the address in full; (8) period (• • — — • •); (9) the body or text of the message; (10) "sig," followed by the signature of the message.

4. The *receiving* operator will add to the message received the month and year, and, after satisfying himself that the check and number of words correspond, will give "O. K.," followed by the call letter of his station and his own personal signal. He will then enter in the proper places, at the head of the blank, the call letter of his own station, with his personal signal and the time the message was received.

5. Communications submitted by telegraph or signals are always confidential and will only be revealed to those entitled to receive them.

OPERATOR'S NUMBER SHEET.

Station, ... Date, ..., 191..

Ko		Ko							
Sent.	Rec'd.	Sent.	Rec'd.	Sent.	Rec'd.	Sent.	Rec'd.	Sent.	Rec'd.
1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9
0	0	0	0	0	0	0	0	0	0

Operators must see that numbers are correct upon being relieved or closing for the day.

"Good night" will not be given to any station until assured that there are no more messages on file for it, that the numbers have been compared and the time and signals of the operators making the comparison recorded upon the number sheet.

PART XIX.

U. S. ARMY FIELD MESSAGE.

Time filed.	No.	Sent by	Time	Received by	Time	Check

These spaces for signal operators only.

From.....

At.....

How sent

Date..... Hour..... No.....

To.....

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